

DOCUMENT RESUME

ED 228 069

SE 041 266

AUTHOR Styer, Sandra
TITLE Questions and the Scientific Process in Experiment Books.
PUB DATE [83]
NOTE 9p.
PUB TYPE Reports - Descriptive (141)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Books; *Childrens Literature; Elementary Education; *Elementary School Science; *Process Education; Questioning Techniques; *Reading Material Selection; Science Education; *Science Experiments
IDENTIFIERS *Questions

ABSTRACT

Science experiment books which typically incorporate relatively large numbers of questions can be an especially important resource for children who are learning scientific processes. These processes include observing, communicating, hypothesizing, experimenting, measuring, classifying, generalizing, and predicting. An analysis of questions in experiment books can determine to what degree they do, in fact, elicit the scientific processes. Such an analysis can sensitize teachers who are responsible for selecting experiment books for the science curriculum. To illustrate this type of analysis, prototype questions eliciting the previously mentioned scientific processes were identified in several well-known science experiment books selected from the 1981 edition of "Children's Catalog." However, that a book is an experiment book is no guarantee that it will provide science-process-oriented questions. Some include few or no questions while others include many memory/recall questions. Consequently, in selecting science experiment books it is essential to assess the nature of the distribution of questions and modal question type in a specific book. Books containing questions which elicit the science processes are valuable, supplementing teachers' efforts to stimulate young scientists. In addition, these questions can be models for children as they develop questioning skills in scientific inquiry. (JN)

* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *

✓ This document has been reproduced as
received from the person or organization
originating it.
Minor changes have been made to improve
reproduction quality.

• Points of view or opinions stated in this docu-
ment do not necessarily represent official NIE
position or policy.

"PERMISSION TO REPRODUCE THIS
MATERIAL HAS BEEN GRANTED BY

Sandra Styer

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC)."

"QUESTIONS AND THE SCIENTIFIC PROCESS IN EXPERIMENT BOOKS"

Sandra Styer

Millicent E. Selsam (1980), one of the most outstanding
and prolific authors of children's science trade books has
written:

Science books can give young people a basic idea of
what an experiment is and why it is so essential to
the scientific method. They can learn the kind of
thought that goes into the formulation of a problem,
the need for control, the necessity for careful
observation, and the drawing of proper conclusions
from what is observed (p. 84).

Science experiment books which typically incorporate
relatively large numbers of questions can be an especially
important resource for children who are learning the
scientific processes. These processes include observing,
communicating, hypothesizing, experimenting, measuring,
classifying, generalizing, and predicting (Blough and Schwartz,
1979, pp. 16-17). An analysis of the questions in experiment
books can determine to what degree they do, in fact, elicit
the scientific processes. Such an analysis can sensitize
teachers who are responsible for selecting experiment books
for the science curriculum. To illustrate this type of analysis,
prototype questions eliciting each of Blough and Schwartz's
eight scientific processes will be identified in some well-
known science experiment books.

Observing is a fundamental process which is basic to other
processes. Questions designed to elicit observing should lead

ED228069

SE 041266

children to increasing degrees of precision. Simon (Exploring Fields and Lots, 1978) described a plant growing project, then asked, "Which plants seem to be sturdier and healthier: the ones left in sun or the ones left in shade?" (p. 27) In directing children to observe insects and small animals in the grass, he questioned, "Do they seem to react to such things as light or shadow or an object in their path?" (p. 53) Zubrowski (Bubbles, 1979) guided the precise examination of a soap film, then inquired, "How many different colors can you see in the soap film," (p. 59) "Do the colors form layers or are they in swirls?" (p. 59) and "Do the patterns seem to change as you look at them from different angles, or as the light changes?" (pp. 59-60)

Communicating is a process closely related to observing. When children are using experiment books with other children or adults, many questions requiring observing may also stimulate communication through oral or written responses. Children who use experiment books may be motivated by their own interests or by the author's suggestions to communicate in writing through various types of record-keeping such as diagrams and graphs. Simon (Exploring Fields and Lots, 1978) suggested that the reader who is exploring fields should keep a log recording the date and time of day, describing the weather and responding to questions such as "What was the temperature?" (p. 12) and "Where were you?" (p. 12)

Hypothesizing or proposing explanations based upon thoughtful observations is often elicited by "why" questions. Simon (Science in a Vacant Lot, 1970) asked, "Can you tell

why the city in summer is usually hotter than the country?" (p. 52) Describing an experiment in which two leaves covered with vaseline turn yellow and fall off, he asked, 'Can you explain why?' (p. 29) Readers of Bendick's How to Make a Cloud, (1971) are informed that most water in clouds comes from the ocean, then they are asked, " . . why doesn't it rain over the ocean and nowhere else?" (p. 26)

Blough and Schwartz (1979) have defined experimenting as " . . . a process to discover something that is not known to the child, to test an hypothesis, or to attempt to solve a real problem . . . " (p. 17) Milgram (Adventures with a Straw, 1967) encourages experimenting when he asked, "What can you move with the air blown from a straw?" (p. 18) Children can respond to a wealth of experimenting questions in Bubbles (Zubrowski, 1979), for example, "What is the largest hemisphere you can make?" (p. 12); "Will blue food coloring give you a blue bubble?" (p. 60) and "Can you make a straight line of bubbles on the tray?" (p. 41)

Measuring is a fundamental and often integral part of other scientific processes. Questions which require various types of measuring can further develop children's concept of precision. In Experimental Fun with the Yo-Yo (1979), Renner instructed readers to try different lengths of strings on their yo-yos, then asked, "What is the limit for the length of a yo-yo string?" (p. 14) and "Which length works best?" (p. 14) When the absorption of water by seeds is studied in Seeing What Plants Do (Rahn, 1972), children are directed to measure beans in a cup before soaking them in water and then

they are to measure the amount again the next day. They are asked, "Has it changed?" (p. 26) In Discovering What Frogs Do (1969), Simon suggested that frog eggs often hatch in four days at 68° Fahrenheit, then inquired, "How do your results compare with this?" (p. 26)

As children develop skill in observing, they compare and contrast to identify likenesses and differences and to subsequently classify living and nonliving things. The process of classifying may be facilitated through questions in experiment books which lead children in careful sequence from observing to classifying. Children learn to classify seeds in Play with Seeds (Selsam, 1957) when they are asked, "What seeds are floating on the water of brooks and streams?" (p. 41); "What seeds stick to your clothes as you walk through a weedy field?" (p. 42) and "Do any of them have wings that will help to carry them through the air?" (p. 42) Simon (Science in a Vacant Lot, 1970) directed children to examine plants and leaves, then asked, "Can you tell which of the plants belongs to the family of grass?" (p. 51); "Does one leaf grow on each stem or is there more than one?" (p. 31); "Does the leaf have toothed edges or is it smooth?" (p. 31) and "What is its shape?" (p. 31)

Generalizing, or organizing facts into meaningful relationships is essential to the scientific process. Questions can be a natural stimulus for generalizing. In Discovering What Frogs Do (1969), Simon described an experiment in which a frog is immersed in cold water, then inquired, "What happens to the number of breathing movements as the temperature drops?" (p. 41) Some questions in Zubrowski's

Bubbles (1979) requiring generalizing were: " . . . if the width of the bubble changes a certain amount, does the height change proportionately?" (p. 49) and "Does a larger amount of glycerine give a longer-lasting bubble?" (p. 54)

Predicting as a scientific process is based upon and often follows the collection of data through other scientific processes. In comparing baking soda and baking powder, Zubrowski (Messing Around with Baking Chemistry, 1981) noted that both fizz a lot with the addition of vinegar, then asked readers to predict, "Which of these powders would you guess gives off the most gas?" (p. 31) As children who read Science in a Vacant Lot (Simon, 1970) count the number of seeds in a seed package, they are asked, "Do you think that most of these seeds will grow into plants?" (p. 54) As they prepare to keep a record of their observations of two plants (one in subsoil and one in topsoil), they are questioned, "Which plant do you think will grow better?" (p. 11) Related to experiments on making layers of bubbles in a jar, Zubrowski (Bubbles, 1979) asked children to predict, "Which layer will break first?" and "Will they last longer on a warm or a cold day?" (p. 55)

The books in this discussion, ones which had been selected for inclusion in the 1981 edition of Children's Catalog, incorporated questions most of which elicited responses related to the eight scientific processes. That a book is an experiment book is no guarantee that it will provide science process-oriented questions. Some experiment books

include few or no questions. Others include many memory/recall-type questions and few which would elicit scientific processes. Consequently, in selecting science experiment books for children, it is essential to assess the questions.

What is the nature of the distribution of questions? What is the modal question type in a specific book? It would be important to be aware, for example, that the majority of questions in one book elicited observing behavior. Then this book could be supplemented with others of similar content which focused on a broader range of questions or a book which offered few or no questions eliciting one of the scientific processes could be used in conjunction with other critically selected books or even carefully prepared teacher questions.

Are the questions answered in the text? If so, do the responses immediately follow the questions or do they come later in the narrative or illustrations? Questions which are answered immediately scarcely function as authentic questions since the response process is probably not elicited from the child before the response is presented in the text. This fails to reinforce the inquiry process or a questioning attitude in children. In an unusual approach, Rahn (Seeing What Plants Do, 1979), avoided this problem through presenting answers to all questions in a separate, well-organized section at the end of the book.

A few otherwise high-quality experiment books might contain few or no questions of any type. Occasionally, these books would be suitable for children who have learned

to independently ask their own questions and to seek answers. At the conclusion of Exploring Fields and Lots (1978), Simon, who asked many questions in this book urged children to write down their own questions assuring them that they need not know every answer. He wrote, "Even a great scientist doesn't know all the answers. A great scientist is more likely to know how to ask the right questions and how to search for the answers." (p. 63) Such a combination of author's and reader's questions would be ideal.

As teachers plan for children's science experiments and for their own demonstrations, related science experiment books incorporating questions which elicit the science processes are invaluable. Experiences with challenging questions in experiment books can supplement teachers' efforts to stimulate young scientists. These questions can be models for children as they develop questioning skills in science inquiry. Finally, appropriate questions can lead children to new ideas for experimenting and to an increased comprehension of the scientific processes.

REFERENCES

- Bendick, Jeanne. How to Make a Cloud. New York: Parents' Magazine Press, 1971.
- Blough, Glenn O. and Schwartz, Julius. Elementary School Science and How to Teach It. 6th. ed. New York: Holt, Rinehart and Winston, 1979.
- Milgram, Harry. Adventures with a Straw, First Science Experiments. Illustrated by Leonard Kessler, New York: E. P. Dutton and Co., Inc., 1967.
- Rahn, Joan Elma. Seeing What Plants Do. Illustrated by Ginny Linville Winter. New York: Atheneum, 1972.
- Renner, Al G. Experimental Fun with the Yo-Yo, and Other Scientific Projects. New York: Dodd, Mead and Co., 1979.
- Schneider, Herman and Schneider, Nina. Science Fun with a Flashlight. Illustrated by Harriet Sherman. New York: McGraw-Hill Book Co., 1975.
- Selsam, Millicent E. Play with Seeds. Illustrated by Helen Ludwig. New York: William Morrow and Co., 1957.
- Selsam, Millicent E. "Science Books: Reflections of a Science Writer." Children's Literature in Education, 11: 82-84, Summer, 1980.
- Simon, Seymour. Discovering What Frogs Do. Illustrated by Jean Zallinger. New York: McGraw-Hill Book Co., 1969.
- Simon, Seymour. Exploring Fields and Lots, Easy Science Projects. Illustrated by Arabelle Wheatley. Champaign, Illinois: Garrard Publishing Co., 1978.
- Simon, Seymour. Science in a Vacant Lot. Illustrated by Kiyo Komoda. New York: The Viking Press, 1970.
- Zubrowski, Bernie. Bubbles, A Children's Museum Activity Book. Illustrated by Joan Drescher. Boston: Little, Brown and Co., 1979.
- Zubrowski, Bernie. Messing Around with Baking Chemistry. Illustrated by Signe Hanson. Boston: Little, Brown and Co., 1981.